



EXPRESS MAIL
LABEL NUMBER EL440976041US

FAU-7036

Inventor: William E. Glenn

COLOR VIDEO CAMERA SYSTEM AND METHOD

RELATED APPLICATIONS

The present Application claims priority from U.S. Provisional Patent Application No. 60/151,965, filed September 1, 1999 and from U.S. Provisional Patent Application No. 60/171,361, filed December 22, 1999, and said Provisional Patent Applications are incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates to a color video camera system that can be utilized for motion picture film origination.

BACKGROUND OF THE INVENTION

Color motion pictures are often made by shooting the action with a film camera, converting the images to digital form, computer processing the digital images, and then scanning the processed images back onto film for release. It would be

advantageous to have a practical electronic color video camera that could directly shoot the action to obtain color video from which good quality color motion picture film could ultimately be produced, but this has not yet been achieved. A major reason is that the expensive high quality lenses used in motion picture film cameras have optical characteristics and requirements that are not readily adaptable to electronic video cameras. A 24 frames per second progressively scanned color video camera for electronic film origination has become available. It is a three-sensor camera that must use lenses designed for television cameras, and cannot achieve the image quality that is obtainable with the high quality lenses used in motion picture film cameras.

It is among the objects of the present invention to devise an electronic color video camera that can utilize the types of high quality lenses that are used in motion picture color film cameras.

| 姓名 | 性别 | 年龄 | 籍贯 | 职业 | 文化程度 | 健康状况 | 婚姻状况 | 子女情况 | 其他 |
|-----|----|----|----|----|------|------|------|------|----|
| 王德胜 | 男 | 45 | 山东 | 工人 | 高中 | 良好 | 已婚 | 2子1女 | |
| 李秀英 | 女 | 38 | 河北 | 教师 | 大学 | 良好 | 已婚 | 1子1女 | |
| 张国强 | 男 | 52 | 河南 | 农民 | 初中 | 一般 | 已婚 | 3子2女 | |
| 刘小红 | 女 | 28 | 江苏 | 护士 | 大专 | 良好 | 未婚 | 无 | |
| 陈为民 | 男 | 60 | 浙江 | 退休 | 小学 | 较差 | 已婚 | 4子3女 | |
| 赵大伟 | 男 | 35 | 四川 | 干部 | 硕士 | 良好 | 已婚 | 1子1女 | |
| 孙丽娟 | 女 | 42 | 湖南 | 医生 | 本科 | 良好 | 已婚 | 2子1女 | |
| 周建民 | 男 | 55 | 湖北 | 工人 | 高中 | 一般 | 已婚 | 3子2女 | |
| 吴小芳 | 女 | 30 | 广东 | 文员 | 大专 | 良好 | 未婚 | 无 | |
| 郑为民 | 男 | 48 | 安徽 | 农民 | 初中 | 一般 | 已婚 | 2子1女 | |
| 冯大刚 | 男 | 58 | 江西 | 退休 | 小学 | 较差 | 已婚 | 4子3女 | |
| 马秀珍 | 女 | 33 | 山西 | 教师 | 大学 | 良好 | 已婚 | 1子1女 | |
| 徐国强 | 男 | 40 | 陕西 | 工人 | 高中 | 良好 | 已婚 | 2子1女 | |
| 郭小红 | 女 | 25 | 福建 | 护士 | 大专 | 良好 | 未婚 | 无 | |
| 黄为民 | 男 | 65 | 广西 | 退休 | 小学 | 较差 | 已婚 | 5子4女 | |
| 周大伟 | 男 | 38 | 云南 | 干部 | 硕士 | 良好 | 已婚 | 1子1女 | |
| 孙丽娟 | 女 | 45 | 贵州 | 医生 | 本科 | 良好 | 已婚 | 2子1女 | |
| 周建民 | 男 | 50 | 四川 | 工人 | 高中 | 一般 | 已婚 | 3子2女 | |
| 吴小芳 | 女 | 35 | 广东 | 文员 | 大专 | 良好 | 未婚 | 无 | |
| 郑为民 | 男 | 45 | 安徽 | 农民 | 初中 | 一般 | 已婚 | 2子1女 | |
| 冯大刚 | 男 | 55 | 江西 | 退休 | 小学 | 较差 | 已婚 | 4子3女 | |
| 马秀珍 | 女 | 30 | 山西 | 教师 | 大学 | 良好 | 已婚 | 1子1女 | |
| 徐国强 | 男 | 40 | 陕西 | 工人 | 高中 | 良好 | 已婚 | 2子1女 | |
| 郭小红 | 女 | 25 | 福建 | 护士 | 大专 | 良好 | 未婚 | 无 | |
| 黄为民 | 男 | 65 | 广西 | 退休 | 小学 | 较差 | 已婚 | 5子4女 | |
| 周大伟 | 男 | 38 | 云南 | 干部 | 硕士 | 良好 | 已婚 | 1子1女 | |
| 孙丽娟 | 女 | 45 | 贵州 | 医生 | 本科 | 良好 | 已婚 | 2子1女 | |
| 周建民 | 男 | 50 | 四川 | 工人 | 高中 | 一般 | 已婚 | 3子2女 | |
| 吴小芳 | 女 | 35 | 广东 | 文员 | 大专 | 良好 | 未婚 | 无 | |
| 郑为民 | 男 | 45 | 安徽 | 农民 | 初中 | 一般 | 已婚 | 2子1女 | |
| 冯大刚 | 男 | 55 | 江西 | 退休 | 小学 | 较差 | 已婚 | 4子3女 | |
| 马秀珍 | 女 | 30 | 山西 | 教师 | 大学 | 良好 | 已婚 | 1子1女 | |
| 徐国强 | 男 | 40 | 陕西 | 工人 | 高中 | 良好 | 已婚 | 2子1女 | |
| 郭小红 | 女 | 25 | 福建 | 护士 | 大专 | 良好 | 未婚 | 无 | |
| 黄为民 | 男 | 65 | 广西 | 退休 | 小学 | 较差 | 已婚 | 5子4女 | |
| 周大伟 | 男 | 38 | 云南 | 干部 | 硕士 | 良好 | 已婚 | 1子1女 | |
| 孙丽娟 | 女 | 45 | 贵州 | 医生 | 本科 | 良好 | 已婚 | 2子1女 | |
| 周建民 | 男 | 50 | 四川 | 工人 | 高中 | 一般 | 已婚 | 3子2女 | |
| 吴小芳 | 女 | 35 | 广东 | 文员 | 大专 | 良好 | 未婚 | 无 | |
| 郑为民 | 男 | 45 | 安徽 | 农民 | 初中 | 一般 | 已婚 | 2子1女 | |
| 冯大刚 | 男 | 55 | 江西 | 退休 | 小学 | 较差 | 已婚 | 4子3女 | |
| 马秀珍 | 女 | 30 | 山西 | 教师 | 大学 | 良好 | 已婚 | 1子1女 | |
| 徐国强 | 男 | 40 | 陕西 | 工人 | 高中 | 良好 | 已婚 | 2子1女 | |
| 郭小红 | 女 | 25 | 福建 | 护士 | 大专 | 良好 | 未婚 | 无 | |
| 黄为民 | 男 | 65 | 广西 | 退休 | 小学 | 较差 | 已婚 | 5子4女 | |
| 周大伟 | 男 | 38 | 云南 | 干部 | 硕士 | 良好 | 已婚 | 1子1女 | |
| 孙丽娟 | 女 | 45 | 贵州 | 医生 | 本科 | 良好 | 已婚 | 2子1女 | |
| 周建民 | 男 | 50 | 四川 | 工人 | 高中 | 一般 | 已婚 | 3子2女 | |
| 吴小芳 | 女 | 35 | 广东 | 文员 | 大专 | 良好 | 未婚 | 无 | |
| 郑为民 | 男 | 45 | 安徽 | 农民 | 初中 | 一般 | 已婚 | 2子1女 | |

Further features and advantages of the invention will become more readily apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram, partially in block form, of an apparatus in accordance with an embodiment of the invention and which can be used in practicing an embodiment of the method of the invention.

Figure 2 is a partially broken away diagram illustrating the two color checkerboard pattern filter that is used in embodiments of the invention.

Figure 3 is a diagram of an opto-acoustical filter, employing a pellicle, that is utilized in embodiments of the invention.

Figure 4 is a diagram of the rotating shutter that can be utilized in embodiments of the invention.

Figure 5 is a schematic diagram, partially in block form, of another embodiment of an apparatus in accordance with the invention and which can be used in practicing another embodiment of the method of the invention.

Figure 6 is a diagram of a rotating shutter that is utilized in the Figure 5 embodiment.

DETAILED DESCRIPTION

Figure 1 shows a camera system in accordance with an embodiment of the invention and which can be utilized in practicing an embodiment of the method of the invention. Light received from a scene 5 being viewed (typically, a moving scene) is received and focused by a motion picture film camera type of lens, represented in the Figure by lens 110, which is typically a multi-element lens or lens system. [As used herein, the term "lens system" is intended to generically cover a lens of one or more elements as well as a system of lenses. The term "lens" is sometimes used as convenient shorthand for a lens system.] Light focused by the lens is divided, in a manner described further hereinbelow, by a pellicle beamsplitter 115, for incidence on sensors 120 and 130 which may be, for example, suitable CCD sensors. In the present embodiment, the sensor 120 is a luminance (Y) sensor, and the sensor 130 is provided with a color pattern filter 132 and serves as a color sensor. (The image on the color sensor is reversed, and can be electronically reversed back on readout). Each sensor is coupled with suitable processing circuitry (labeled 125 in the luminance channel and labeled 135 in the color channel), including color detect and matrix circuitry in the color channel, and suitable filtering in both channels. The signals can be combined and matrixed, as

the Y sensor have the spectral distribution appropriate for Y. The remaining light is mostly red and blue. In an embodiment hereof, the color filter 132 of Figure 1 employs red and blue diagonally sampled filters. This is shown in Figure 2, which illustrates a checkerboard pattern having cross-hatched boxes 210 representative of red, and non-cross-hatched boxes 220 representative of blue. This provides a diagonally sampled red and blue color output. The horizontal and vertical resolution of these colors is consequently the same as the luminance resolution. However, the diagonal resolution is half that of the luminance diagonal resolution. This is acceptable since there is normally less detail in the diagonal directions in images and the human visual system has less color acuity on the diagonal. Using this filter, R-Y and B-Y can be derived from the signals from the two sensors. The Y signal is obtained from the luminance sensor 120. In this embodiment, R, B, and Y are gamma corrected before subtracting. This gives a signal that is very close to $\log R/Y$ and $\log B/Y$, which are isoluminant color signals. This has a considerable advantage over color difference signals that are produced from a Y signal that is derived from the sum of gamma corrected R, G, and B (which is not isoluminant). The only disadvantage is that to derive green, one must first obtain gamma corrected R and B signals by adding gamma corrected Y to the color signals and then the R, B, and Y signals must be un-gamma corrected to give linear signals before subtracting the

appropriate proportions of R and B from Y to get green. The green then needs to be gamma corrected. Reference can be made to W.E. Glenn et al., Logarithmic A/D Converters Used In Video Signal Processing Systems, SMPTE Journal, 101/5, May, 1992. By using diagonally sampled R and B signals, the horizontal resolution and vertical resolution of R and B are the same as Y. The diagonal resolution, however, is half the diagonal resolution of Y, which is 1.4 times its horizontal resolution. The combination of a diagonally sampled two color sensor (rather than a 3 color sensor) combined with isoluminant color signals will give improved rendition of brightness in saturated colors. This is an advantage for "blue screen" processing.

In further embodiment of the Figure 2 color filter, the checkerboard passes red and green; i.e., for example, the boxes 210 being red and the boxes 220 being green. This embodiment has the advantage of having blue (rather than green) be the derived color, since the derived color will have the lowest signal-to-noise ratio, and this can be best tolerated in the blue.

In reading out the checkerboard patterns, the R and G (or R and B) images in the checkerboard pattern can be decimated (e.g. by setting odd pixels to zero on line 1 (and all odd lines) and even pixels to zero on line 2 (and all even lines). Interpolation can be used to obtain the missing pixels. The luminance channel signal can be appropriately filtered to obtain a lower resolution luminance signal for derivation and processing

